Level Properties

Energy: for all discrete levels and giant resonances; identify analog resonances. Adopt minimum number of levels consistent with source datasets.

Jpi:

- Use fewest and best args. For definite Jpi; the more args. the better for uncertain J or π. Convince reader; enable quick check on impact of new data.
- Use flags for long, repetitive arguments (e.g., “Jpi based on presence of primary γ from ½+ capture state in (n, γ) E=thermal and logf1ut<8.5 from 1/2- in … EC decay”).
- If directly measured (e.g., atomic beam), give method.
- μ no longer a strong argument.
- Avoid multiply-placed γ’s in “γ to Jπ” type arguments.

- "γ's to 3/2+ and 5/2-" (2 levels) differs from "γ's to 3/2+, 5/2-" (1 level).
- "γ to Jπ" is a <u>weak</u> argument.
- In "γ to …" args., level Jpi is what matters, not E(level).
- Use "logft=…from <u>Jπ=…</u>" and L(d,p)=2 for <u>9/2+ target</u>" type arguments.

$T_{1/2}$ (or Γ):

- Give bare-atom values in comment (e.g., "$T_{1/2}(^{52}Fe^{26+})$= …").
- Specify "from B(E2)↑ in Coulomb excitation", etc.
- Remember $\Gamma=\Gamma_\gamma+\Gamma_p+\ldots$ for resonance, so note any assumptions such as '$\Gamma=\Gamma_{\gamma 0}+\Gamma_{\gamma 1}$' or '$\Gamma=\Gamma_p$'.

Band Flag: (if relevant)

Isospin: very important for low A!

Decay Branches: for g.s. and $T_{1/2} \geq 0.1$ s levels, include all modes that might reasonably be expected. ← Example 2

XREF Flags:

- Use ‘X(*)’ if level from dataset X cannot be uniquely identified with level in question.
- Use ‘X(energy)’ to resolve any ambiguity due to poor energy match between adopted level and dataset X level. ← Example 3
- Watch for systematic energy scale deviations between various reaction studies.
- Avoid associating a transfer reaction level with an adopted level whose configuration it could not excite.

← Example 4

Moments (μ, Q): static, model-independent values.

- Summarized in 89Ra17 (evaluation) and 01StZZ (listing).
- State method used.
- Mention standards used, corrections applied (e.g., Sternheimer).
- Signs matter.

- Convert g-factor data to μ. ← Example 5

B(Lλ)↑:
Give only when measured, but branching or $T_{1/2}$ unknown.
$\langle r^2 \rangle$ (DAVRSQ): include data in comment on g.s. (or isomer) if available.

Gamma Properties

Energy:

- If E came from level energy difference, say so and recalculate after GTOL run (without that E_γ included, of course).

Rel. Branching: scale I_γ so strongest branch is 100; omit uncertainty if only 1 branch. Give TI for E0 or fully converted transitions.

Exceptions: ← Example 6

- Strongest line is multiply placed (&).
- Strongest line is given as a limit.
- Transition is within an SD band.

Mult.:

- [mult] means 'deduced solely from level scheme'; use [E2], etc., if need to calculate transition prob. or CC for line with no exptl. mult.
- Convert 'D' or 'Q' to '(E1)', '(E2)', etc., only if needed for calculation; specify how $\Delta\pi$ was deduced.

- Remember that ‘M1,E2’ and ‘M1+E2’ are <u>not</u> equivalent.

Mixing Ratio:

- Include sign, if known. Absence of sign indicates modulus δ.
- If 2 solutions, give <u>both</u> in comment, <u>none</u> in MR field.
- Watch for cases where expt. gives higher limit than RUL allows.

Conv. Coeff.: give when significant.

Red. Transn. Probs.:

- Give whenever calculable.
- If δ overlaps 0 or ∞, calculate for D or Q only.
- Calc. for [E1], [E2], [ΔJ>2].
- Watch for data given as limit. ← Example 7

E0 Transitions:

Quote ρ^2(E0) from 99Wo07.

<u>Omit</u> from Adopted Gammas:

- Coincidence information.
- 2_G records from HSICC.
- Unplaced gammas.

```
167IR    ADOPTED LEVELS
167IR C  Production: 92MO(78KR,p2n) E=357, 384 MEV (1997DA07).
167IR C  Identification: 1981HO10 unambiguously assign a new |a group to 167IR
167IR2C  by relating it to known transitions through a multi-dimensional
167IR3C  analysis correlating parent energies, daughter energies, and the
167IR4C  timing of events. The production reactions involved 58NI on
167IR5C  molybdenum-tin targets and 107AG on vanadium-nickel targets
167IR C  For calculation of proton decay widths for 167IR GS and isomer see
167IR2C  2000DA11.
167IR  Q             11760   SY-1070   6 6507     5    1995AU04,1997DA07
167IR CQ            |DS(n)=300 (1995AU04).
167IR CQ QA$from measured EA=6351 5 (1997DA07) for GS to GS transition; 1995AU04
167IR2CQ give QA=6495 50, reflecting lack of information concerning daughter
167IR3CQ state at that time.
167IR CQ SP         From measured EP=1064 6 (1997DA07) for GS to GS transition;
167IR2CQ SP=-1110 10 in 1995AU04.
167IR  XA171AU A DECAY (1.02 MS)
167IR  XB78KR(92MO,2NPG)
167IR  L 0             (1/2+)           35.2 MS   20
167IR2 L %A=48 6 (1997DA07)$%P=32 4 (1997DA07)$%EC+%B+=?
167IRX L XREF=B
167IR CL J          comparison of calculated and measured partial lifetimes for
167IR2CL p decay rule out d{-3/2} and h{-11/2} transitions, so 1997DA07 conclude
167IR3CL that an L=0 p is emitted to the 0+ GS of 166OS.
167IR CL %A,%P      From relative intensities of |a and p decay from level,
167IR2CL assuming …
```

Example 1: new Q measurements

```
192PO    ADOPTED LEVELS, GAMMAS                                        98NDS    199809
192PO  H TYP=FUL$AUT=Coral M. Baglin$CIT=NDS 84, 717 (1998)$CUT=1-Aug-1998$
192PO C  Identification: excitation functions for 182W(20NE,XN) (1977DE32).
192PO C  Activity (T=0.5 S 1, EA=6580 KEV 40), attributed in 1958TO25 to 192PO,
192PO2C  disagrees with systematics and with data of 1981LE23.
192PO CL J         From (36AR,4NG); based on IG, |a|g|g coin, and level-energy
192PO2CL systematics for neighboring nuclei, 1996HE22 tentatively identify
192PO3CL the observed gammas with the E2 cascade of the GS band of 192PO.
192PO CG E         From (36AR,4NG); uncertainties not stated by authors.
192PO  Q              11.0E3 SY 2.2E3  SY 7320    7    1995AU04
192PO CQ             |DS(n)=360, |DS(p)=450 (1995AU04).
192PO  XA196RN A DECAY
192PO  XB160DY(36AR,4NG),
192PO  L 0.0          0+               33.2 MS   14
192POX L XREF=AB
192PO2 L %A AP 99.5 $ %EC+%B+ AP 0.5 $
192PO CL           %A: only A DECAY observed. %(EC+B+) AP 0.4 can be
192PO2CL estimated from gross B decay theory (partial T AP 8 S) (1973TA30), or
192PO3CL AP 0.54 from partial BETA T of 6.1 S calculated by 1997MO25.
192PO CL T         from 1996BI17. Others: 34 MS 3 (1981LE23); 32 MS (1995MO14;
192PO2CL from time difference between feeding |a and decay |a); 34 MS +80-20 and
192PO3CL 52 MS +88-37 (1997PU01).
192PO  L 262          (2+)
192POX L XREF=B
192PO  G  262
```

Example 2: decay branches

```
59NI  L 5821      10
59NIX L XREF= BN(*5830)
59NI CL           JPI=3/2+ FROM (POL P,D) AND L(P,D)=2 FOR 5821 AND/OR
59NI2CL 5844 LEVEL(S).
59NI  L 5844      10 (3/2+,5/2+)
59NIX L XREF=BN(*5830)
59NI CL           JPI=3/2+ FROM (POL P,D) AND L(P,D)=2 FOR 5821 AND/OR
59NI2CL 5844 LEVEL(S).
```

Example 3: XREF’s

^{169}Tm(d,p) Target: 1/2[411]p g.s.
n stripped from d

^{170}Tm states must be 1/2[411]p$\otimes\Omega$[xxx]n

Populated:

1/2[411]p $\pm$ 1/2[521]n
1/2[411]p $\pm$ 5/2[512]n
1/2[411]p $\pm$ 7/2[633]n
1/2[411]p $\pm$ 3/2[521]n

<u>Not</u> populated:

7/2[404]p $\pm$ 7/2[633]n
1/2[541]p $\pm$ 5/2[512]n
1/2[541]p $\pm$ 7/2[633]n

```
167LU  L      0.0+X   1/2(+)           1 M       GE                          CM
167LUX L XREF=B
167LU2 L %EC+%B+=?$%IT=?
167LU3 L MOMM1=-0.0999 13 (1998GE13)$
167LU CL           DAVRSQ(170LU,167LU)=-0.291 (1998GE13); 10% systematic
167LU2CL uncertainty.
167LU CL           J,MOMM1: from collinear fast beam laser spectroscopy
167LU2CL (1998GE13). PI based on proximity of MOMM1 to value expected for
167LU3CL 1/2[411] orbital (-0.05) cf. that for the only other nearby J=1/2
167LU4CL orbital (viz. 1/2[541], |m AP +0.7).
167LU CL T         estimated by 1998GE13; based on known rare-earth diffusion …
```

Example 5: μ, $\Delta\langle r^2\rangle$, etc.

	Source Dataset			Adopted Dataset		
	RI	TI		RI	TI	
L 1847						
G 1200	50	5		67	7	
G 1700	150	15	… &	20	LT	… &
G 1847	75	8		100	10	
L 2147						
G 1000	-	10.0	1	-	20.0	2
G 1500	25.0	25		50	5	
G 2000	50	5		100	10	
G 2147	150	LT		300	LT	

Example 6: Photon branching

Reduced Transition Probability Calculations (Special Cases)

I: Data given as limit:

(i) $\delta(M1,E2)<0.3$:

B(E2)W: give as upper limit.

B(M1)W: give av. of B(M1)W(δ=0) and B(M1)W(δ=0.3).

(ii) TI<i for non-dominant branch:

Assign 1/2i $\pm$ 1/2i to this transition to enable calculation of B(Lλ)W's for other branches.

(iii) $T_{1/2}$<t:

Give resulting lower limits on B(Lλ)W's.

(iv) $T_{1/2}$>t:

- Typically, forget it !
- However, B(E2)W<0.005 or B(E1)W< $2x10^{-10}$ might, e.g., be worth mentioning.

II: When $T_{1/2}$ was calculated directly from B(Lλ)W:

Calculate B(Lλ)W$\downarrow$ from measured B(Lλ)W$\uparrow$ and single-particle value (available from RULER).

```
183HG CL BAND(A)   1/2[521], |a=+1/2 BAND.
183HG2CL This band differs from that in adopted levels primarily because
183HG3CL 1995SH04 assign an 88.9G (rather than the 86.5G) as the 5/2 to 1/2
183HG4CL transition. Also, the tentatively-placed 41/2 to 37/2 transition has
183HG5CL been omitted from adopted levels.
183HG CL BAND(a)   1/2[521], |a=-1/2 BAND.
183HG2CL This signature partner differs significantly from that in adopted
183HG3CL levels. All four transitions connecting this band with the 1/2[521]
183HG4CL |a=+1/2 band are different; so are the 3 in-band transitions
183HG5CL cascading to the J=27/2 member. Two of the latter are retained in
183HG6CL adopted levels, but not as members of this band; the tentatively
183HG7CL placed 39/2 to 35/2 637G is not adopted.
```

Example 9: Discrepant Bands (b)

```
167YB CL BAND(a)   5/2[523], |a=-1/2 BAND (1976ME06,1995FI01).
167YB2CL 1995FI01 suggest 3/2[521] or 1/2[521] for this band, but neither is
167YB3CL compatible with earlier assignments (e.g., 1971AB04), for the low-J
167YB4CL members of those bands. Note also that the 301 level, assigned by
167YB5CL 1995FI01 as the J=11/2 member of this band, previously had been
167YB6CL assigned (1976GR06,1976ME06) as the 11/2 member of the 5/2[523] band,
167YB7CL as adopted here. Based on band parameters, the 11/2 1/2[521] and 11/2
167YB8CL 3/2[521] levels would be expected at 730 and 540 KEV, respectively.
167YB9CL THE J=11/2 THROUGH 31/2 MEMBERS OF THIS BAND HAVE ENERGIES VERY CLOSE
167YBACL TO THOSE OF THE 5/2[523] BAND IN THE ISOTONE 169LU, AND THE ALIGNMENT
167YBBCL APPEARS TO BE CONSISTENT WITH THIS BEING THE SIGNATURE PARTNER OF
167YBCCL THE 5/2[523], |a=+1/2 BAND.
167YB CL BAND(B)   5/2[642], |a=+1/2 BAND (1995FI01).
167YB2CL CORIOLIS perturbed level spacing.
167YB CL BAND(b)   5/2[642], |a=-1/2 BAND (1995FI01).
167YB CL BAND(C)   1/2[521] BAND (1971AB04).
167YB2CL A=13.6, a=+0.71 (1/2, 3/2, 5/2, 7/2 levels); note that values for ^A
167YB3CL and a are in excellent agreement with those expected for a 1/2[521]
167YB4CL band. However, see comment with the PI=-, |a=-1/2 band re a possibly
167YB5CL conflicting assignment of this configuration.
```

Example 10: Discrepant Bands (c)